

```
SHW = PLANT-EQUIPMENT TYPE = DHW-HEATER SIZE = -999 ..  
END ..  
COMPUTE PLANT ..
```

*Additional capability for this system:*

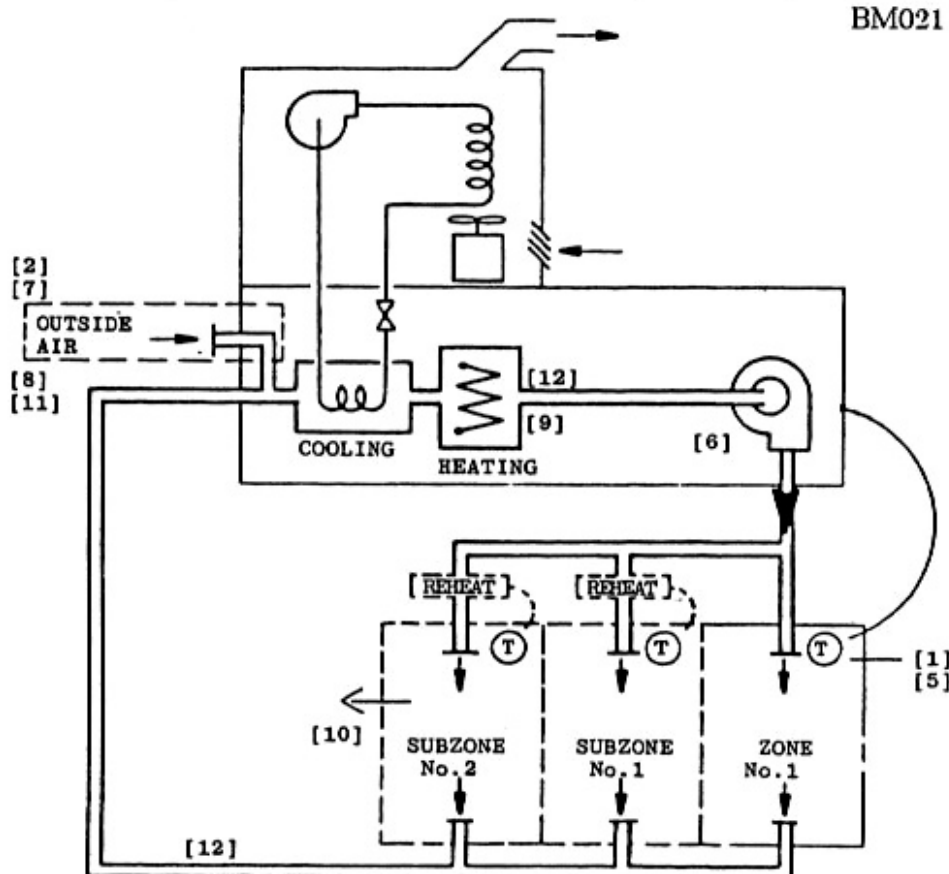
- 1) To disable the availability of either cooling or heating, insert schedules like that shown for TPFC; however, you may enter values representing outside air temperatures above and below which the cooling and heating is on, as follows:

```
HEAT-ON = SCHEDULE  THRU MAY 15 (ALL) (1,24)(70)  
                    THRU SEP 15 (ALL) (1,24)(0)  
                    THRU DEC 31 (ALL) (1,24)(70) ..  
  
COOL-ON = SCHEDULE  THRU DEC 31 (ALL) (1,24)(60)  
                    THRU SEP 15 (ALL) (1,24)(1)  
                    THRU DEC 31 (ALL) (1,24)(60) ..
```

### Packaged Single Zone Air Conditioner with Heating and Subzone Reheating Options (PSZ)

This hybrid system/plant, usually larger than a PTAC, cools by the direct expansion of a refrigerant and may optionally heat with gas, hot water, or an electric resistance heater. This unit is usually considered a commercial unit; it provides constant volume air to a control zone and constant- or variable-air volume flow to optional subzones. If you want variable volume air to all zones, that can be modeled by using the PVAVS system. This forced-air packaged unit may be either a unitary system (rooftop unit or outside-the-wall unit) or it may be a split unit (partially inside and partially outside). It may or may not require ducting. In its most basic configuration, PSZ consists of a compressor, air-cooled condenser, evaporator with a fan supplying cooled air to the indoors, filter (not shown), and thermostat. PSZ can optionally be specified with a central heating device, subzone reheating device(s), outside ventilation air, and economizer cooling. The supply fan may be either a blowthrough or a drawthrough type, with the fan motor either inside or outside the air stream. The condenser fan operates automatically on demand. An exhaust air fan and/or a return air fan may optionally be specified. The thermostat may be specified with night setback and night cycle control.

*Note: On the schematic, items shown in dashed boxes are optional components.*



**Figure 3.18:** Packaged Single Zone Air Conditioner with Heating and Subzone Reheating Options (PSZ)

*Suggested minimal input for PSZ system:*

INPUT SYSTEMS ..

SYSTEMS-REPORT SUMMARY=(SS-A,SS-H,SS-O) ..

# \$ SYSTEMS SCHEDULES

FANS-ON = SCHEDULE THRU DEC 31	(WD)	(1,7)(0) (8,18)(1) (19,24)(0)
	(WEH)	(1,24)(0) ..
COOLSETPT = SCHEDULE THRU DEC 31	(WD)	(1,7)(99) (8,18)(76) (19,24)(99)
	(WEH)	(1,24)(99) ..
HEATSETPT = SCHEDULE THRU DEC 31	(WD)	(1,7)(55) (8,18)(72) (19,24)(55)
	(WEH)	(1,24)(55) ..
DHW = SCHEDULE THRU DEC 31	(WD)	(1,7)(0) (8,18)(1.0) (19,24)(0)
	(WEH)	(1,24)(0) ..

OFFICE = ZONE	DESIGN-HEAT-T	=	72	
	DESIGN-COOL-T	=	74	
	HEAT-TEMP-SCH	=	HEATSETPT	[1]
	COOL-TEMP-SCH	=	COOLSETPT	[1]
	OA-CFM/PER	=	15 ..	[2]
AC-SYST = SYSTEM	SYSTEM-TYPE	=	PSZ	
	MAX-SUPPLY-T	=	110	[3]
	MIN-SUPPLY-T	=	55	[4]
	NIGHT-CYCLE-CTRL	=	CYCLE-ON-FIRST	[5]
	FAN-SCHEDULE	=	FANS-ON	[6]
	OA-CONTROL	=	TEMP	[7]
	ECONO-LIMIT-T	=	60	[8]
	HEAT-SOURCE	=	FURNACE	[9]
			\$ or HEAT-PUMP,	
			\$ ELECTRIC, or	
			\$ HOT-WATER	
	ZONE-NAMES	=	(OFFICE) ..	
P1 = PLANT-ASSIGNMENT	SYSTEM-NAMES	=	(AC-SYST)	
	DHW-BTU/HR	=	10000	
	DHW-SCH	=	DHW ..	

```

END ..
COMPUTE SYSTEMS ..
INPUT PLANT ..
P1 = PLANT-ASSIGNMENT ..
PLANT-REPORT SUMMARY = (BEPS) ..
SHW = PLANT-EQUIPMENT TYPE = DHW-HEATER SIZE = -999 ..
END ..
COMPUTE PLANT ..

```

*Additional capabilities for this system:*

- 1) To enable an exhaust fan add the keywords EXHAUST-CFM = Value (CFM) and EXHAUST-KW = Value (.0001 is typical) to the ZONE keyword list. [10]
- 2) To disable the economizer change OA-CONTROL = TEMP to OA-CONTROL = FIXED. [11]
- 3) To enable control of maximum humidity and use compressor superheat for reheat, insert MAXIMUM-HUMIDITY = Value (60% is allowed under the new ASHRAE 90.1 Standard) and also MAX-COND-RCVRY = Value (.5 is typical) in the SYSTEM keyword list. Note that REHEAT-DELTA-T must also be specified. [12]
- 4) If HOT-WATER is the type of HEAT-SOURCE selected, you must also insert a hot water generator in PLANT.
- 5) Water cooled condenser and water side economizer options are available for this system. See "Water Cooled Condenser Option for Packaged Units PSZ, PVAVS, and PVVT" in the *Supplement (2.1E)*.

### Packaged Multizone Fan System (PMZS)

PMZS is a multizone constant-volume forced-air system (actually a hybrid system/plant) that cools by the direct expansion of a refrigerant and heats with gas, hot water, or an electric resistance heater. PMZS may have heat recovery from condenser coils. PMZS usually consists of a manufacturer-matched set of components within a single enclosure that is rooftop mounted, but it may also be a split unit (partially inside and partially outside). In its most basic configuration, PMZS consists of one or more refrigeration compressors, one or more air-cooled condensers with a fan discharging heat to the outdoors, one or more evaporators with a fan supplying cooled air to the indoors, a heating device, filter (not shown), and a thermostat in each zone. PMZS can optionally be specified with outside ventilation air, economizer cooling, an exhaust fan and a return fan. It has a blowthrough fan, with the fan motor either inside or outside the airstream. The condenser fan operates automatically on demand. The thermostat may be specified with night setback and night cycle control.

In the DOE-2 simulation of PMZS, there is individual control of temperature in the different zones, with no preconditioning of outside ventilation air.

*Note: On the schematic, items shown in dashed boxes are optional components.*

BM022

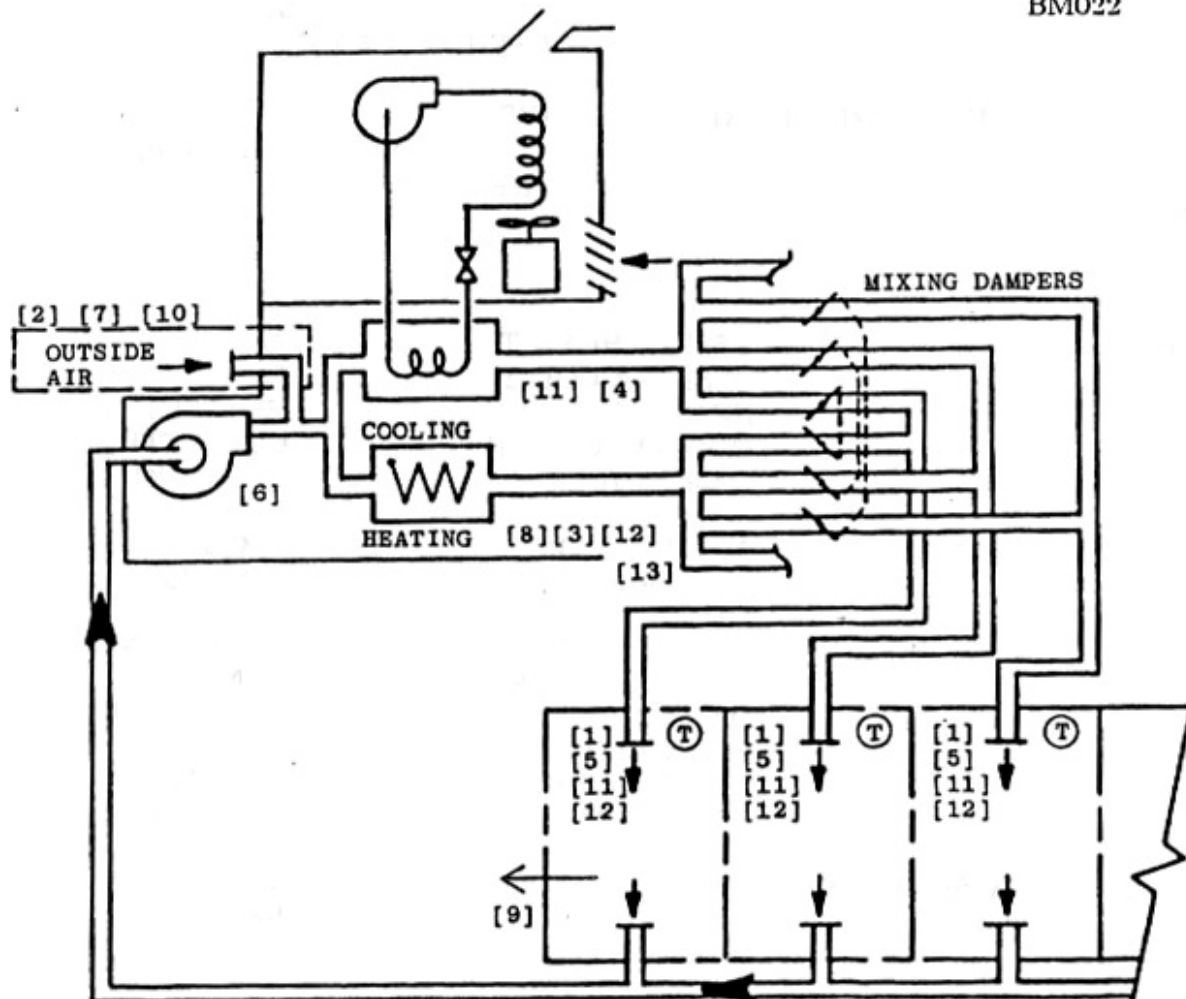


Figure 3.19: Packaged Multizone Fan System (PMZS)

*Suggested minimal input for PMZS system:*

INPUT SYSTEMS ..

SYSTEMS-REPORT SUMMARY=(SS-A,SS-H,SS-O) ..

# \$ SYSTEMS SCHEDULES

FANS-ON = SCHEDULE THRU DEC 31	(WD)	(1,7)(0) (8,18)(1)
		(19,24)(0)
	(WEH)	(1,24)(0) ..
COOLSETPT = SCHEDULE THRU DEC 31	(WD)	(1,7)(99) (8,18)(76)
		(19,24)(99)
	(WEH)	(1,24)(99) ..
HEATSETPT = SCHEDULE THRU DEC 31	(WD)	(1,7)(55) (8,18)(72)
		(19,24)(55)
	(WEH)	(1,24)(55) ..
DHW = SCHEDULE THRU DEC 31	(WD)	(1,7)(0)
		(8,18)(1.0) (19,24)(0)
	(WEH)	(1,24)(0) ..

OFFICE = ZONE	DESIGN-HEAT-T	=	72	
	DESIGN-COOL-T	=	74	
	HEAT-TEMP-SCH	=	HEATSETPT	[1]
	COOL-TEMP-SCH	=	COOLSETPT	[1]
	OA-CFM/PER	=	15 ..	[2]
AC-SYST = SYSTEM	SYSTEM-TYPE	=	PMZS	
	MAX-SUPPLY-T	=	110	[3]
	MIN-SUPPLY-T	=	55	[4]
	NIGHT-CYCLE-CTRL	=	CYCLE-ON-ANY	[5]
	FAN-SCHEDULE	=	FANS-ON	[6]
	OA-CONTROL	=	TEMP	[7]
	ECONO-LIMIT-T	=	60	[7]
	HEAT-SOURCE	=	ELECTRIC	[8]
	ZONE-NAMES	=	(OFFICE) ..	
P1 = PLANT-ASSIGNMENT	SYSTEM-NAMES	=	(AC-SYST)	
	DHW-BTU/HR	=	10000	
	DHW-SCH	=	DHW ..	

END ..

COMPUTE SYSTEMS ..

```

INPUT PLANT ..
P1 = PLANT-ASSIGNMENT ..
PLANT-REPORT SUMMARY = (BEPS) ..
SHW = PLANT-EQUIPMENT  TYPE = DHW-HEATER  SIZE = -999 ..
END ..
COMPUTE PLANT ..

```

*Additional capabilities for this system:*

- 1) To enable an exhaust fan add the keywords EXHAUST-CFM = Value (CFM) and EXHAUST-KW = Value (.0001 is typical) to the ZONE keyword list. [9]
- 2) To disable the economizer change the OA-CONTROL = TEMP to OA-CONTROL = FIXED. [10]
- 3) To simulate a discriminator control of the cold deck supply air temperature add COOL-CONTROL = WARMEST to the SYSTEM keyword list. [11]
- 4) To simulate a discriminator control of the hot deck supply air temperature add HEAT-CONTROL = COLDEST to the SYSTEM keyword list. [12]
- 5) Alternatives to items 3 and 4 above are reset of cold and hot deck supply air temperature. An example of this control is covered in the *Sample Run Book (2.1E)* 31-Story Office Building, Run 1.
- 6) To simulate turning off the hot deck whenever the outside temperature is above 65°F, insert a new schedule like this: [13]

HEAT-OFF = SCHEDULE THRU DEC 31 (ALL) (1,24) (65) ..

and add

HEATING-SCHEDULE = HEAT-OFF

to the SYSTEM keyword list.

### Packaged Variable-Air-Volume System (PVAVS)

PVAVS is a variable-volume system/plant that cools the zones by direct expansion of a refrigerant and optionally heats the zones with gas, fuel oil, hot-water, or an electric resistance heater. In the cooling mode the supply air temperature is usually constant and the volume of air is varied from minimum to maximum to satisfy the zone requirements. In the heating mode the supply air temperature is varied in response to the zone requirements and the volume of air is held at the minimum (constant). In its most basic configuration, PVAVS consists of a compressor, air-cooled condenser with a fan discharging heat to the outdoors, evaporator with a fan supplying cooled air to the indoors, reheat coils at the zone level, filter (not shown), variable-volume control boxes, and thermostats. PVAVS unit can be optionally specified with outside ventilating air, exhaust fan, return air fan, and economizer control. The supply fan may be either a blowthrough or drawthrough, with the fan motor either inside or outside the airstream. The thermostat may be specified with night setback and night cycle control.

*Note: On the schematic, items shown in dashed boxes are optional components.*

BM023

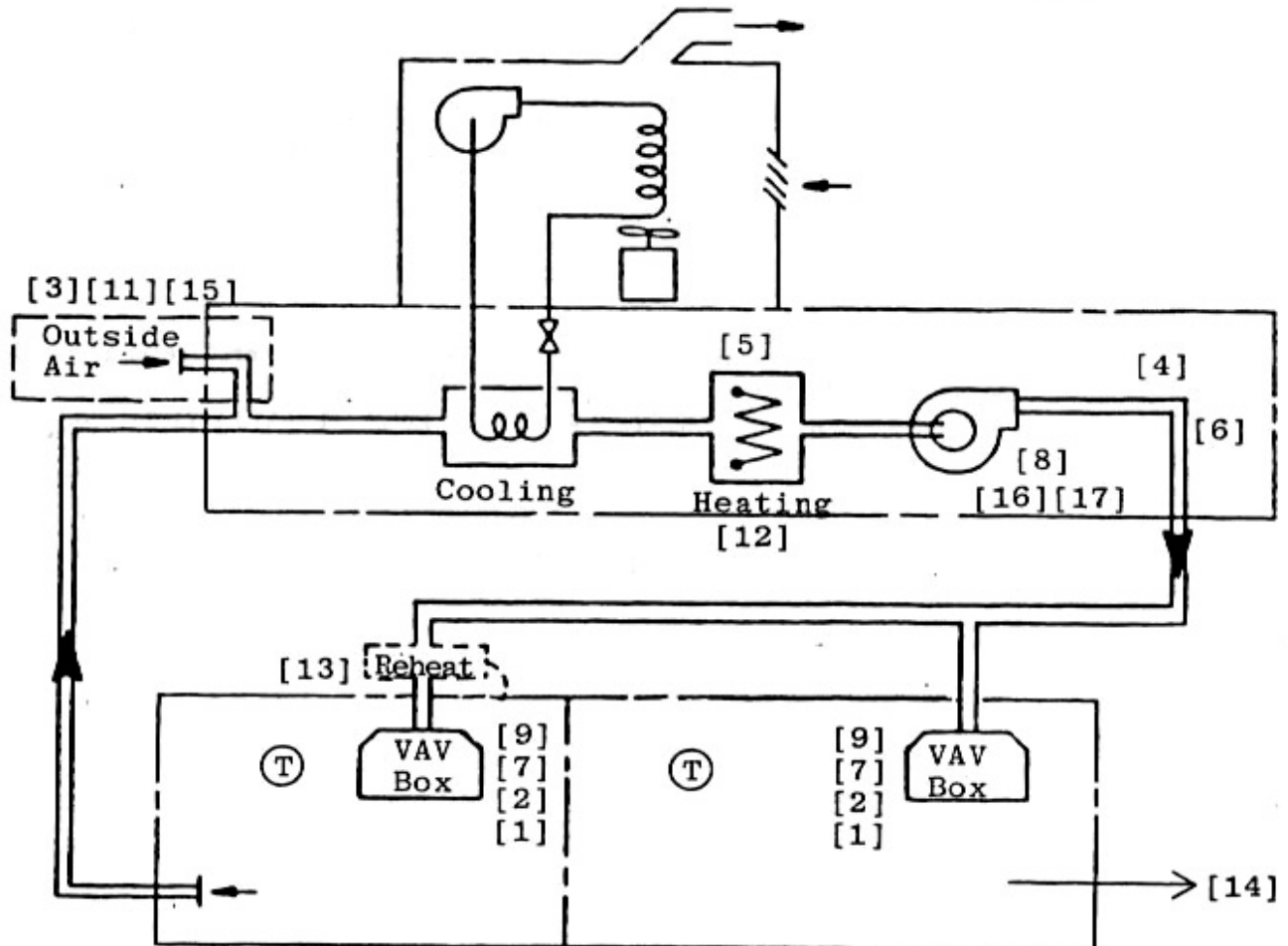


Figure 3.20: Packaged Variable-Air-Volume System (PVAVS)



*Suggested minimal input for PVAVS system:*

INPUT SYSTEMS ..

SYSTEMS-REPORT SUMMARY=(SS-A,SS-H,SS-O) ..

# \$ SYSTEMS SCHEDULES

FANS-ON = SCHEDULE THRU DEC 31	(WD)	(1,7)(0) (8,18)(1)
		(19,24)(0)
	(WEH)	(1,24)(0) ..
COOLSETPT = SCHEDULE THRU DEC 31	(WD)	(1,7)(99) (8,18)(76)
		(19,24)(99)
	(WEH)	(1,24)(99) ..
HEATSETPT = SCHEDULE THRU DEC 31	(WD)	(1,7)(55) (8,18)(72)
		(19,24)(55)
	(WEH)	(1,24)(55) ..
DHW = SCHEDULE THRU DEC 31	(WD)	(1,7)(0)
		(8,18)(1.0) (19,24)(0)
	(WEH)	(1,24)(0) ..

OFFICE = ZONE	DESIGN-HEAT-T	=	72	
	DESIGN-COOL-T	=	74	
	HEAT-TEMP-SCH	=	HEATSETPT	[1]
	COOL-TEMP-SCH	=	COOLSETPT	[1]
	THERMOSTAT-TYPE	=	REVERSE-ACTION	[2]
	OA-CFM/PER	=	15 ..	[3]

AC-SYST = SYSTEM	SYSTEM-TYPE	=	PVAVS	
	MAX-SUPPLY-T	=	110	[4]
	HEAT-SET-T	=	70	[5]
	MIN-SUPPLY-T	=	55	[6]
	NIGHT-CYCLE-CTRL	=	CYCLE-ON-ANY	[7]
	FAN-SCHEDULE	=	FANS-ON	[8]
	MIN-CFM-RATIO	=	.3	[9]
	REHEAT-DELTA-T	=	55	[10]
	OA-CONTROL	=	TEMP	[11]
	ECONO-LIMIT-T	=	60	[11]
	HEAT-SOURCE	=	ELECTRIC	[12]
	ZONE-HEAT-SOURCE	=	ELECTRIC	[13]
	ZONE-NAMES	=	(OFFICE) ..	

P1 = PLANT-ASSIGNMENT	SYSTEM-NAMES	=	(AC-SYST)	
	DHW-BTU/HR	=	10000	
	DHW-SCH	=	DHW ..	

```

END ..
COMPUTE SYSTEMS ..
INPUT PLANT ..
P1 = PLANT-ASSIGNMENT ..
PLANT-REPORT SUMMARY = (BEPS) ..
SHW = PLANT-EQUIPMENT   TYPE = DHW-HEATER   SIZE = -999 ..
END ..
COMPUTE PLANT ..

```

*Additional capabilities for this system:*

- 1) To enable an exhaust fan add the keywords EXHAUST-CFM = Value (CFM) and EXHAUST-KW = Value (.0001 is typical) to the ZONE keyword list. [14]
- 2) To enable a humidifier which requires heat to evaporate water into the air add MIN-HUMIDITY = Value (25% is typical) to the SYSTEM keyword list.
- 3) To enable heat recovery to exchange relief air heat with outside air heat add RECOVERY-EFF = Value (0.6 is typical) to the SYSTEM keyword list.
- 4) To disable the economizer change OA-CONTROL = TEMP to OA-CONTROL = FIXED. [15]
- 5) To enable variable speed control of the fan motor, insert FAN-CONTROL = SPEED to the SYSTEM keyword list. [16]
- 6) To simulate riding the fan curve with neither inlet vanes nor speed control, insert FAN-CONTROL = DISCHARGE to the keyword list. [17]
- 7) Water cooled condenser and water side economizer options are available for this system. See "Water Cooled Condenser Option for Packaged Units PSZ, PVAVS, and PVVT" in the *Supplement (2.1E)*.